



**REPORT OF
SUBSURFACE EXPLORATION AND
GEOTECHNICAL ANALYSIS**

**DMA TAMPA RED BRICK BUILDING
TAMPA, FLORIDA**

**FOR
MRI ARCHITECTURAL GROUP, INC.**

JANUARY 7, 2015



January 7, 2015

Mr. Pete Ikegami
MRI Architectural Group
5032 Goddard Avenue
Orlando, Florida 32804

ECS Project No.: 41-1329

Reference: Report of Subsurface Exploration and Geotechnical Engineering Services, DMA
Tampa Red Brick Building, 2313 West Lemon Street, Tampa, Florida 33609

Dear Mr. Ikegami:

As authorized by acceptance of proposal no. 41-545 Revision 1, dated September 15, 2014, ECS-Florida, LLC (ECS) has completed the subsurface exploration and conducted geotechnical engineering analyses for the proposed building addition located at 2313 West Lemon Street in Tampa, Hillsborough County, Florida. Our report includes the results of our subsurface exploration program, laboratory testing program, and geotechnical engineering analyses is attached.

Based on aerial photographs, we understand the subject property is currently developed as the National Guard Armory Facility. It is our understanding the proposed construction will consist of the renovation of the existing brick building as well as adding structural components to the building located near the southeastern portion of the parcel. Structural information was not available at the time of the report preparation; however, we have assumed that the new structural components will be relatively lightly loaded with maximum column loads on the order of 30 kips or less and wall loads of 3 kips per lineal foot. We have also assumed that cuts and/or fills will be on the order of two feet or less to reach proposed finished floor elevation.

This geotechnical evaluation includes an evaluation of the subsurface soil and groundwater conditions of the site and general area as described in scope of services identified in our proposal. No other additional issues were explored, requested or proposed during this evaluation.

The conclusions and recommendations presented within this report are based upon a reasonable level of exploration within normal bounds and standards of professional practice for a site in this particular geographic and geologic setting. This report has been prepared to aid in the evaluation of this site and to assist the Owner and Engineer in the feasibility study of the project. The report scope is limited to the specific project and location described, and the project description represents our understanding of the significant aspects relevant to soil and foundation characteristics, based on two soil test borings and geotechnical analysis.

Observations, conclusions and recommendations about geotechnical conditions at the subject site are necessarily limited to conditions observed, and/or materials reviewed at the time this study was undertaken. No warranty, express or implied, is made about the conclusions and recommendations presented within this report. This report is provided for the exclusive use of MRI Architectural Group. This report is not intended to be used or relied upon about other projects or by other unidentified third parties. The use of this report by any undesignated third party or parties will be at such party's sole risk and ECS disclaims liability for any such third party use or reliance.

We appreciate this opportunity to be of service to you on this project. If you have any questions about the information and recommendations contained in the accompanying report, or if we may be of further assistance to you in any way during planning or construction of this project, please contact us.

Respectfully,

ECS-FLORIDA, LLC
Certificate of Authorization No. 26152



Chris M. Egan, P.E. (VA)
Project Manager



Mike A. Santiago, P.E.
Principal Engineer
P.E. 74520



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PROJECT OVERVIEW

Introduction

This report presents the results of our subsurface exploration and geotechnical engineering analysis for the proposed building addition to the National Guard Armory Facility located at 2313 West Lemon Street in Tampa, Florida, as authorized by your office. In preparing this report, we have utilized information from our current subsurface exploration. The site and boring locations are shown on the Boring Location Plan included in the Appendix.

It is our understanding the proposed construction will consist of the renovation of the existing brick building as well as adding structural components to the building located near the southeastern portion of the parcel. Structural information was not available at the time of the report preparation; however, we have assumed that the new structural components will be relatively lightly loaded with maximum column loads on the order of 30 kips or less and wall loads of 3 kips per lineal foot. We have also assumed that cuts and/or fills will be on the order of two feet or less to reach proposed finished floor elevation.

The description of the proposed project as given above is based on information provided to us by your office. If any of this information is in error, either due to our misunderstanding or due to any design changes which may occur later, we recommend that ECS be contacted so that we may review our recommendations and provide any alternate or additional recommendations considered warranted at that time.

Scope of Service

The conclusions and recommendations contained in this report are based on our field subsurface explorations and review of available geologic and/or geotechnical data. The recent subsurface exploration program included two soil borings, extended to depths of approximately 10 feet and 30 feet below existing ground surface.

The boring locations for the proposed were selected by your office and located in the field by representatives of ECS. No site survey was available for our field exploration. Consider the indicated locations and depths to be approximate. Our layout crew located the borings based upon standard pacing and taping techniques and visually estimated distances and relationships to obvious landmarks. The Boring Location Plan is included in the Appendix.

Our exploration was confined to the zone of soil likely to be stressed by the proposed construction. Our work did not address the potential for surface expression of deep geological conditions, such as sinkhole development related to karst activity. This evaluation requires a more extensive range of field services than performed in this study. We will be pleased to conduct an exploration to evaluate the probable effect of the regional geology upon the proposed construction, if you desire.

This report presents an evaluation of site conditions on the basis of traditional geotechnical procedures for site characterization. The recovered samples were not examined, either visually or analytically, for chemical composition or environmental hazards. ECS would be pleased to perform these services, if you desire.

Purposes of Exploration

The purposes of the exploration were to explore the soil and groundwater conditions at the site and to develop engineering recommendations to guide the geotechnical design and construction of the current project. We accomplished these purposes by:

1. Drilling borings to explore the subsurface soil and groundwater conditions,
2. Perform one test pit to expose the foundation of the existing building,
2. Performing laboratory tests on selected representative soil samples from the test borings to evaluate pertinent engineering properties and,
3. Analyzing the field and laboratory test results to develop appropriate engineering recommendations.
4. Developing this geotechnical engineering report.

EXPLORATION PROCEDURES

Subsurface Exploration Procedures

The soil borings were performed with an ATV-mounted drilling rig, which used continuous mud rotary methods to advance the boreholes. Drilling fluid was used in this process. Please note that each of the borings were advanced to depths of approximately four feet below existing grades with hand auger equipment because of concerns relating to existing utilities.

Representative soil samples were obtained by the split-barrel sampling procedure per ASTM Specification D-1586. In this procedure, a 2-inch O.D., split-barrel sampler is driven into the soil a distance of 18 inches or 24 inches by a 140-pound hammer falling 30 inches. The number of blows required to drive the sampler through a 12-inch interval is termed the Standard Penetration Test (SPT) value, or "N" value, and is indicated for each sample on the boring logs. This value can be used as a qualitative indication of the in-place relative density of non-cohesive soils. In a less reliable way, it also indicates the consistency of cohesive soils. This indication is qualitative, since many factors can significantly affect the standard penetration resistance value and prevent a direct correlation between drill crews, drill rigs, drilling procedures, and hammer-rod-sampler assemblies.

A field log of the soils encountered in each boring was maintained by the drill crew. After recovery, each sample was removed from the sampler and visually classified. Representative portions of each sample were then sealed and delivered to our laboratory for further visual identification.

Laboratory Testing Program

Representative soil samples were selected and tested in our laboratory to check the field classification and to determine pertinent engineering properties. The laboratory testing program included visual classifications, natural moisture content tests, and wash No. 200 testing of selected soil samples. All data obtained from the laboratory testing program is included on respective boring logs and on separate laboratory sheets within the Appendix of this report.

Each soil sample was visually classified on the basis of texture and plasticity in accordance with the Unified Soil Classification System (USCS). The group symbols for each soil type are indicated in parentheses following the soil descriptions on the boring logs. A brief explanation of the USCS is included with this report. The samples were grouped by various soil types into the major zones noted on the boring logs. The stratification lines designating the interfaces between earth materials on the boring logs and profiles are approximate; in situ, the transitions may be gradual, rather than distinct.

The soil samples obtained from this exploration will be retained at our laboratory for a period of 60 days from the time drilling was completed. After 60 days from completion of drilling, they will be discarded unless we receive other direction from your office.

EXPLORATION RESULTS

Soil Conditions

Subsurface conditions within the project site were evaluated with two soil test borings. Boring B-1 was performed within the proposed addition footprint and extended to a depth of 30 feet below ground surface. Boring B-2 was performed within the pavement area and was extended to a depth of 10 feet below ground surface. The approximate boring locations are shown on the Boring Location Plan in the Appendix of this report.

In general, the soils encountered consisted of sand with silt (SP-SM) to a depth of 2 feet below ground surface, fine sand (SP) to a depth of 17 feet below ground surface, sand with clay (SP-SC) to a depth of 22 feet below ground surface, and lean clay (CL) to a depth of 27 feet below ground surface. Boring B-1 encountered weathered limestone at a depth of approximately 27 feet below existing grade to the boring termination depth. SPT N-values ranged from 6 blows per foot to 50 blows with 5 inches of sampler penetration, indicating a relative density of loose to extremely dense for the cohesionless soils and medium stiff to very hard for the cohesive soils. For more detailed boring information, please see the attached boring logs located in the Appendix of this report.

Groundwater Observations

On the basis of depth to water measurements made in the open boreholes, we estimate that the groundwater level was encountered at a depth of approximately 4 feet below the existing ground surface at the time of drilling. The groundwater will fluctuate seasonally depending upon local rainfall. The rainy season in Central Florida is normally between June and September. Based upon our site specific field data and our experience in the area, we estimate the seasonal high groundwater levels to be about 0.5 feet above the encountered water level at the boring locations. Variations in the location of the long-term water table may occur as a result of changes in precipitation, evaporation, surface water runoff, and other factors not apparent at the time of this exploration.

Existing Foundation

ECS performed one test pit located at the southwest corner of the existing building to expose the existing foundation. The existing foundation measured approximately 13 inches thick and extended approximately 14.5 inches from the wall of the building.

ANALYSES AND RECOMMENDATIONS

The recommendations presented in this report are based on the project information provided to us, the results of the soil test borings, and the engineering analyses. Considering the results of our field exploration, and our experience with similar projects, it is our judgment that the proposed construction may be supported on a shallow foundation system consisting of spread footings. The existing on-site soils are considered to be suitable for the support of the building slab on grade, provided that the subgrade soils have been properly prepared, as described in this report, and approved by the Geotechnical Engineer or their authorized representative.

Foundation

According to the test borings and assumed floor grades for the proposed building, the materials anticipated at normal footing depths below the proposed floor slab should consist of Sand (SP) soils. Based on the results of the subsurface exploration, our recommendations outlined in the "**Earthwork Operations**" section, and our engineering analysis, we recommend that the proposed building be supported on spread footing foundations or a monolithic foundation.

Structural information was not available at the time of the report preparation; however, we have assumed that the new building will be relatively lightly loaded with maximum column loads on the order of 30 kips or less and wall loads of 3 kips per lineal foot. The geotechnical analyses of the test boring data indicate the sand soils expected at subgrade levels should be suitable for a recommended allowable bearing pressure of 2,500 psf as long as they are prepared as recommended within the earthwork operations section of this report. The net allowable soil bearing pressure refers to that pressure which may be transmitted to the foundation bearing soils in excess of the final minimum surrounding overburdened pressure.

Exposure to the environment may weaken the soils at the footing bearing level if the foundation excavations remain open for too long a time. Therefore, foundation concrete should be placed the same day that excavations are made. If the bearing soils are softened by surface water intrusion or exposure, the softened soils must be removed from the foundation excavation bottom immediately prior to placement of concrete. If the excavation must remain open overnight, or if rainfall becomes imminent while the soils are exposed, we recommend that a 1 inch to 3 inch thick "mud mat" of "lean" concrete be placed on the bearing soils before the placement of reinforcing steel.

Settlement of individual footings designed in accordance to recommendations outlined above is expected to be small and within tolerable limits for the proposed structure. Within the proposed building, total settlements of less than 1 inch are anticipated with differential settlements per 30 foot of wall footing expected to be on the order of 1/2 inch or less. These settlement estimates are based on our engineering experience with these soils and are provided to guide the structural engineer with their design.

Our settlement analysis assumes the soils from the bottom of the footings to a depth of 3 feet have been compacted prior to placing concrete in the footings. As such, we recommend this zone be compacted to at least 95 percent of the maximum dry density, as determined by the Modified Proctor Compaction Test (ASTM D-1557). Generally, the moisture content of the sub-footing soils should be maintained within 2 percentage points of the optimum moisture content for the fill material, as determined by ASTM D-1557. One compliance compaction test should

be performed at least every 2,000 square feet per foot of assumed improvement. We recommend that continuous footings have a minimum width of 1½ feet and that isolated column footings have a minimum lateral dimension of 2½ feet. The minimum dimensions recommended above help reduce the possibility of foundation bearing failure and excessive settlement due to local shear or "punching" action.

All continuous load-bearing wall foundations should be suitably reinforced. To provide continuity and reduce the effects of differential settlements, the longitudinal reinforcing steel should be extended into any column footings situated along the wall footings and the foundations should be constructed as a continuous unit through monolithic concrete placement to the greatest extent practical. The reinforcing steel also should be continuous through the building corners. Where top and bottom steel is included in the continuous wall foundations, a minimum footing thickness of 1 foot should be provided. Prior to the placement of any foundation concrete, the steel reinforcement should be observed to document that the bars are properly sized and positioned in accordance with the foundation plans and specifications.

Floor Slab Design

According to the test borings and recommendations included in this report, soils at the floor slab subgrade should consist of firm Sand (SP) soils or newly placed engineered fill, which should be suitable for floor slab support. The subgrade should be prepared in accordance with our recommendations outlined in the section entitled "**Earthwork Operations**". The slabs can then be designed as slab on grade with a modulus of subgrade reaction of 120 pci.

Earthwork Operations

Subgrade Preparation

The existing ground surface in the proposed structural areas should be stripped of all construction debris, vegetation, rootmat, topsoil, and any other soft or unsuitable material from the proposed building area. The stripping within the proposed building area should be extended at least 5 feet, where possible, beyond the planned limits.

The footing locations should be undercut to a depth of 3 feet below finished grade and the soils may be reused and recompacted in accordance with the section of this report entitled "**Fill Placement**." After stripping to the desired grade and prior to fill placement, the exposed soils should be observed by an experience Geotechnical Engineer, or their authorized representative. The building pad of the proposed addition should be rolled multiple times in the parallel and perpendicular directions with a smooth drum roller with a minimum capacity of 10 tons. Once this operation is completed proofrolling using a loaded dump truck, having an axle weight of at least 10 tons, may be used to aid in identifying localized soft or unsuitable material which should be removed and replaced with an approved engineered fill compacted to the criteria given below in the section entitled "**Fill Placement**".

Fill Placement

Any fill to be placed on site should consist of soils classified SP per ASTM D-2487 and have less than 5 percent passing the No. 200 sieve. The upper 2 feet to 12 feet of the on-site soils

should be suitable for reuse as compacted fill, provided that the natural moisture content is within an acceptable range to obtain compaction. **Clayey sand (SC) soils identified within 2 feet of pavement subgrade or finished floor elevation should be observed by the geotechnical engineer of record for acceptance and preparation recommendations. Possible mixing with onsite clean sands may be required to control plasticity and moisture content of any encountered clayey sands.**

Structural fill should be placed in loose lifts, which do not exceed 12 inches in thickness, and should be compacted to at least 95 percent of the maximum dry density, as determined by the Modified Proctor Compaction Test (ASTM D-1557). Generally, the moisture content of the fill materials should be maintained between 2 % below to the optimum moisture content for the fill material, as determined by ASTM D-1557. Fill placed in non-structural areas (e.g. grassed areas) should be compacted to at least 90% of the maximum dry density according to ASTM D-1557, in order to avoid significant subsidence. Compliance tests should be performed at a rate of 1 test per 2,000 square feet per foot of improvement (depth) in the structures areas and 1 test per 5,000 square feet in paved areas.

If any problems are encountered during the earthwork operations, or if site conditions deviate from those encountered during our subsurface exploration, the Geotechnical Engineer should be notified immediately.

Borrow Suitability

- 1) Fine sand (SP) can be utilized as structural and pavement subgrade fill material provided that the natural moisture content is within a desirable range to obtain compaction.
- 2) Fine sand with silt (SP-SM) and silty sand (SM) can be utilized as structural and pavement subgrade fill material provided that the natural moisture content is within a desirable range to obtain compaction. It should be noted that due to higher fine content, soil may be more sensitive to moisture and may require more handling.
- 3) Clayey fine sand (SC) is more difficult to use as fill, because they are more moisture sensitive. These soils may be utilized under the building and pavement areas with a minimum of 2 feet separation and a topping of fine sand (SP) over the silty/clayey soils.

Pavement Considerations

Our scope of services did not include extensive sampling and LBR testing of existing subgrade or potential sources of imported fill for the specific purpose of a detailed pavement analysis. Instead, we have assumed pavement-related design parameters that are considered to be typical for the area soil types.

The recommended pavement thicknesses presented in this report section are considered typical and minimum for the assumed parameters in the general site area. We understand that budgetary considerations sometimes warrant thinner pavement sections than those presented. However, the client, the owner, and the project designers should be aware that thinner pavement sections may result in increased maintenance costs and lower than anticipated pavement life. We recommend the following pavement section designs:

Flexible Pavement Standard-Duty Section:

- 2.0 inches asphaltic concrete surface course (FDOT Type S-1 or S-3)
- 8 inches base course
- 12 inches stabilized subgrade

Rigid Pavement Light-Duty Section:

- 5 inches Portland cement concrete
- 12 inches of compacted, well-draining granular subgrade

Subgrade

All pavement subgrades should be prepared in accordance with the recommendations presented in the section entitled Earthwork Operations.

In areas where Portland cement concrete pavement is planned, the concrete should be placed upon a minimum of 12 inches of compacted, free draining material and compacted to 98% of the Modified Proctor maximum dry density (ASTM D-1557).

In areas where asphaltic concrete pavements are used, we suggest stabilizing the subgrade materials to a minimum Florida Bearing Value (FBV) of 75 pounds per square inch (psi). As an alternate for the FBV, materials can have a Limerock Bearing Ratio (LBR) of 40 percent. All stabilized subgrade materials should be compacted to **98 percent** of the Modified Proctor (ASTM D-1557) maximum dry density and meet specification requirements for Type B or Type C Stabilized Subgrade by the Florida Department of Transportation (FDOT). The stabilized subgrade may consist of imported material or a blend of on-site soils and imported materials. If a blend is proposed, we recommend that the contractor perform a mix design to find the optimum mix proportions.

Base Course

Based on the observed water table as identified in the borings, ECS recommends that the base course be limerock.

Limerock should have a minimum LBR of 150 percent and should be mined from an FDOT approved source. Place limerock in maximum 6-inch lifts and compact each lift to a minimum density of 98 percent of the Modified Proctor maximum dry density.

If the client elects to use crushed concrete as the base material, it should follow the FDOT specification for material qualifications and placement. Place crushed concrete base in maximum 6-inch lifts and compact to a minimum density of 98 percent of the Modified Proctor maximum dry density according to specification in ASTM D-1557.

Perform compliance testing for the base course to a depth of 1 foot at a frequency of one test per 5,000 square feet, or at a minimum of two test locations, whichever is greater.

Effects of Groundwater

One of the most critical influences on the pavement performance in Northern Florida is the relationship between the pavement subgrade and the seasonal high groundwater level. Many

roadways and parking areas have been destroyed as a result of deterioration of the base and the base/surface course bond. Regardless of the type of base selected, we recommend that the seasonal high groundwater and the bottom of the base course be separated by at least 12 inches for crushed concrete and 24 inches for limerock.

Landscape Drains and Curbing

If needed, where landscaped sections are located adjacent to parking lots or driveways, we recommend that drains be installed around these landscaped sections to protect the asphalt pavement from excess rainfall and over irrigation. Migration of irrigation water from the landscape areas to the interface between the asphalt and the base usually occurs unless landscape drains are installed. This migration often causes separation of the wearing surface from the base and subsequent rippling and pavement deterioration. The underdrains or strip drains should be routed to a positive outfall at the pavement area catch basins.

Curbing around landscaped sections adjacent to parking lots and driveways should be constructed with full-depth curb sections. Using extended curb sections which lie directly on top of the final asphalt level, or eliminating curbing entirely, can allow migration of irrigation water from the landscaped areas to the interface between the asphalt and the base. This migration often causes separation of the wearing surface from the base and subsequent rippling and pavement deterioration.

Geoenvironmental Concerns

The equipment, techniques, and personnel used to perform a geoenvironmental study differ significantly from those used to perform a geotechnical study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. Unanticipated environmental problems have led to numerous project failures. If you have not already obtained your own geoenvironmental information, ECS would be pleased to assist with these services. ECS recommends that you not rely on reports prepared for someone else.

Construction Considerations

Exposure to the environment may weaken the soils at the footing bearing level if the foundation excavations remain open for too long a time. Therefore, foundation concrete should be placed the same day that excavations are dug during the rainy season or if rain is anticipated. If the bearing soils are softened by surface water intrusion or exposure, the softened soils must be removed from the foundation excavation bottom immediately prior to placement of concrete. If the excavation must remain open overnight, or if rainfall becomes imminent while the bearing soils are exposed, we recommend that a 1-inch to 3-inch thick "mud-mat" of "lean" concrete be placed on the bearing soils before the placement of reinforcing steel.

Proper compaction of controlled fill is an important aspect of this project. Therefore, we recommend that all fill operations be observed on a full-time basis by a qualified soil technician to determine if minimum compaction requirements are being met.

The surficial soils contain fines which are considered moderately erodible. The Contractor should provide and maintain good site drainage during earthwork operations to help maintain the integrity of the surface soils. The surface of the site should be kept properly graded in order to enhance drainage of the surface water away from the proposed construction areas during the earthwork phase. We recommend that surface drainage be diverted around the proposed structural area without significantly interrupting its pattern. All erosion and sedimentation shall be controlled in accordance with sound engineering practice and current state and local requirements.

In a dry and undisturbed state, the upper 1 foot of the majority of the soil at the site will provide good subgrade support for fill placement and construction operations. However, when wet, these soils will degrade quickly with disturbance from contractor operations. Therefore, good site drainage should be maintained during earthwork operations, which will help maintain the integrity of the soil.

Report Limitations

This report has been prepared to aid in the evaluation of this site and to assist the design team with the design of the proposed facility. The report scope is limited to this specific project and the location described. The project description represents our current understanding of the significant aspects of the proposed improvements relevant to the geotechnical considerations.

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. ECS reviewed field and laboratory data and then applied professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ – sometimes significantly – from those indicated in this report. Retaining ECS to provide construction observation is one of the most effective methods of managing the risks associated with unanticipated conditions.

The analysis and recommendations are, of necessity, based on the information made available to us at the time of the actual writing of the report and the on-site conditions, surface and subsurface that existed at the time the exploratory borings were drilled. Further assumptions have been made that the limited exploratory borings, in relation both to the aerial extent of the site and to depth, are representative of conditions across the site. If subsurface conditions are encountered which differ significantly from those reported herein, this office should be notified immediately so that the analyses and recommendations can be reviewed for validity.

A geotechnical engineering report is based upon conditions that existed at the time the study was performed. Do not rely on this report if the adequacy may have been affected by: passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events such as floods, hurricanes, or groundwater fluctuations.

Always contact ECS before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems. Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of study. Typical factors include: the client's goals, objectives, and risk management preferences; the nature of the structure involved, its size, and configuration; the location of the structure on site; and other planned or existing site improvements, such as access roads, parking lots, underground utilities. Unless ECS indicates otherwise, do not rely on this report if it was not prepared for you; not prepared for your

project; not prepared for the specific site explored; or completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that effect: the function of the proposed structure; elevation, configuration, location, orientation, or weight of the proposed structure; composition of the design team; or project ownership. As a general rule, always inform ECS of project changes – even minor ones – and request an assessment of their impact. ECS cannot accept responsibility or liability for problems that occur because our report does not consider developments of which we were not informed.

The report was designed to meet the specific needs that we have discussed. **This report should not be relied upon to fulfill the needs of contractors.** No one should rely on this report without first consulting with ECS. Furthermore, no one should apply this report for any purpose or project except the one originally contemplated.

ECS recommends that the complete geotechnical report be provided to contractors, but that it should be prefaced with a clearly written letter of transmittal. In that letter, advise contractors that **the report was not prepared for purposes of bid development** and that the report's accuracy is limited. We recommend that the contractor retain ECS to conduct additional study to obtain the specific types of information they need or prefer. A pre-bid conference may also be valuable. Be sure contractors have sufficient time to perform additional study. Only then might you be in a position to give contractors the available information, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Do not over rely on the construction recommendations included in this report. These recommendations are not final. We can finalize our recommendations only by observing actual subsurface conditions revealed during construction. The placement of any new engineered fill will require adequate monitoring during construction in order to confirm that the fill mass is installed properly to avoid future settlements. Because of our in-depth knowledge of the subsurface conditions at the site, we recommend that ECS observe all earthwork and construction operations to confirm that the work is being performed in accordance with the project specifications. It is also recommended that ECS be allowed to prepare or at least review the project specifications with regard to the earthwork for this site. ECS cannot assume responsibility or liability if we do not perform full-time construction observation during earthwork operations and foundation installation.

Closing

We would appreciate the opportunity to continue our involvement on the project during construction. ECS-Florida, LLC would appreciate the opportunity to offer our construction materials testing, threshold inspections, and facilities engineering services.

APPENDIX

Unified Soil Classification System

Reference Notes for Boring Logs

Boring Logs B-1 and B-2

Laboratory Testing Summary

Boring Location Plan

Unified Soil Classification System (ASTM Designation D-2487)

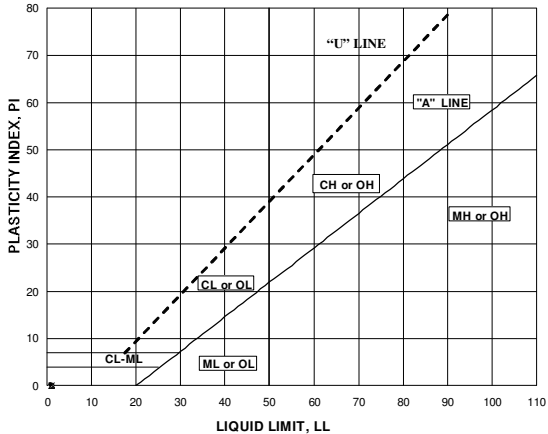
Major Division	Group Symbol	Typical Names	Classification Criteria	
Coarse-grained soils More than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	GW	Well-graded gravels and gravel-sand mixtures, little or no fines	
		GP	Poorly graded gravels and gravel-sand mixtures, little or no fines	
		GM	Silty gravels, gravel-sand-silt mixtures	
		GC	Clayey gravels, gravel-sand-clay mixtures	
		SW	Well-graded sands and gravelly sands, little or no fines	
	Sands More than 50% of coarse fraction passes No. 4 sieve	SP	Poorly graded sands and gravelly sands, little or no fines	
		SM	Silty sands, sand-silt mixtures	
		SC	Clayey sands, sand-clay mixtures	
		Fine-grained soils 50% or more passing No. 200 sieve	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
OL	Organic silts and organic silty clays of low plasticity			
MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts			
CH	Inorganic clays of high plasticity, fat clays			
OH	Organic clays of medium to high plasticity			
Highly organic soils	Pt	Peat, muck and other highly organic soils	Fibrous organic matter; will char, burn, or glow	

Classification on basis of percentage of fines

Less than 5% Pass No. 200 sieve
 More than 12% Pass No. 200 sieve
 5% to 12% Pass No. 200 sieve
 GW, GP, SW, SP
 GM, GC, SM, SC
 Borderline classification requiring use of dual symbol

$C_u = D_{60}/D_{10}$ Greater than 4
 $C_z = (D_{30})^2/(D_{10} \times D_{60})$ Between 1 and 3
 Not meeting both criteria for GW
 Atterberg limits plot below "A" line or plasticity index less than 4
 Atterberg limits plot above "A" line and plasticity index greater than 7
 $C_u = D_{60}/D_{10}$ Greater than 6
 $C_z = (D_{30})^2/(D_{10} \times D_{60})$ Between 1 and 3
 Not meeting both criteria for SW
 Atterberg limits plot below "A" line or plasticity index less than 4
 Atterberg limits plot above "A" line and plasticity index greater than 7

Note: U-line represents approximate upper limit of LL and PI combinations for natural soils (empirically determined). ASTM-D2487.



Plasticity chart for the classification of fine-grained soils. Tests made on fraction finer than No. 40 sieve



UNIFIED SOIL CLASSIFICATION SYSTEM

REFERENCE NOTES FOR BORING LOGS

I. Drilling Sampling Symbols:

SS	Split Spoon Sampler	ST	Shelby Tube Sampler
RC	Rock Core, NX, BX, AX	PM	Pressuremeter
DC	Dutch Cone Penetrometer	RD	Rock Bit Drilling
BS	Bulk Sample of Cuttings	PA	Power Auger (no sample)
HAS	Hollow Stem Auger	WS	Wash Sample

II. Correlation of Penetration Resistances to Soil Properties:

Standard Penetration (Blows/Ft) refers to the blows per foot of a 140 lb. Hammer falling 30 inches on a 2-inch OD split spoon sampler, as specified in ASTM D-1586. The blow count is commonly referred to as the N value.

A. Non-Cohesive Soils (Silt, Sand, Gravel and Combinations)

Density		Relative Properties	
Under 4 blows/ft	Very Loose	Adjective Form	12% to 49%
4 to 10 blows/ft	Loose	With	5% to 12%
11 to 30 blows/ft	Medium Dense		
31 to 50 blows/ft	Dense		
Over 51 blows/ft	Very Dense		

Particle Size Identification		
Boulders		8 inches or larger
Cobbles		3 to 8 inches
Gravel	Coarse	1 to 3 inches
	Medium	½ to 1 inch
	Fine	¼ to ½ inch
Sand	Coarse	2.00 mm to ¼ inch (dia. of lead pencil)
	Medium	0.42 to 2.00 mm (dia. of broom straw)
	Fine	0.074 to 0.42 mm (dia. of human hair)
Silt and Clay		0.0 to 0.074 mm (particles cannot be seen)

B. Cohesive Soils (Clay, Silt, and Combinations)

Blows/ft	Consistency	Unconfined Comp. Strength Q _p (tsf)	Degree of Plasticity	Plasticity Index
Under 2	Very Soft	Under 0.25	None to Slight	0 – 4
2 to 4	Soft	0.25-0.49	Slight	5 -7
4 to 8	Med. Stiff	0.50-0.99	Medium	8 - 22
9 to 15	Stiff	1.00-1.99	High to Very High	Over 22
16 to 30	Very Stiff	2.00-3.00		
Over 30	Hard	Over 4.00		

III. Water Level Measurement Symbols:

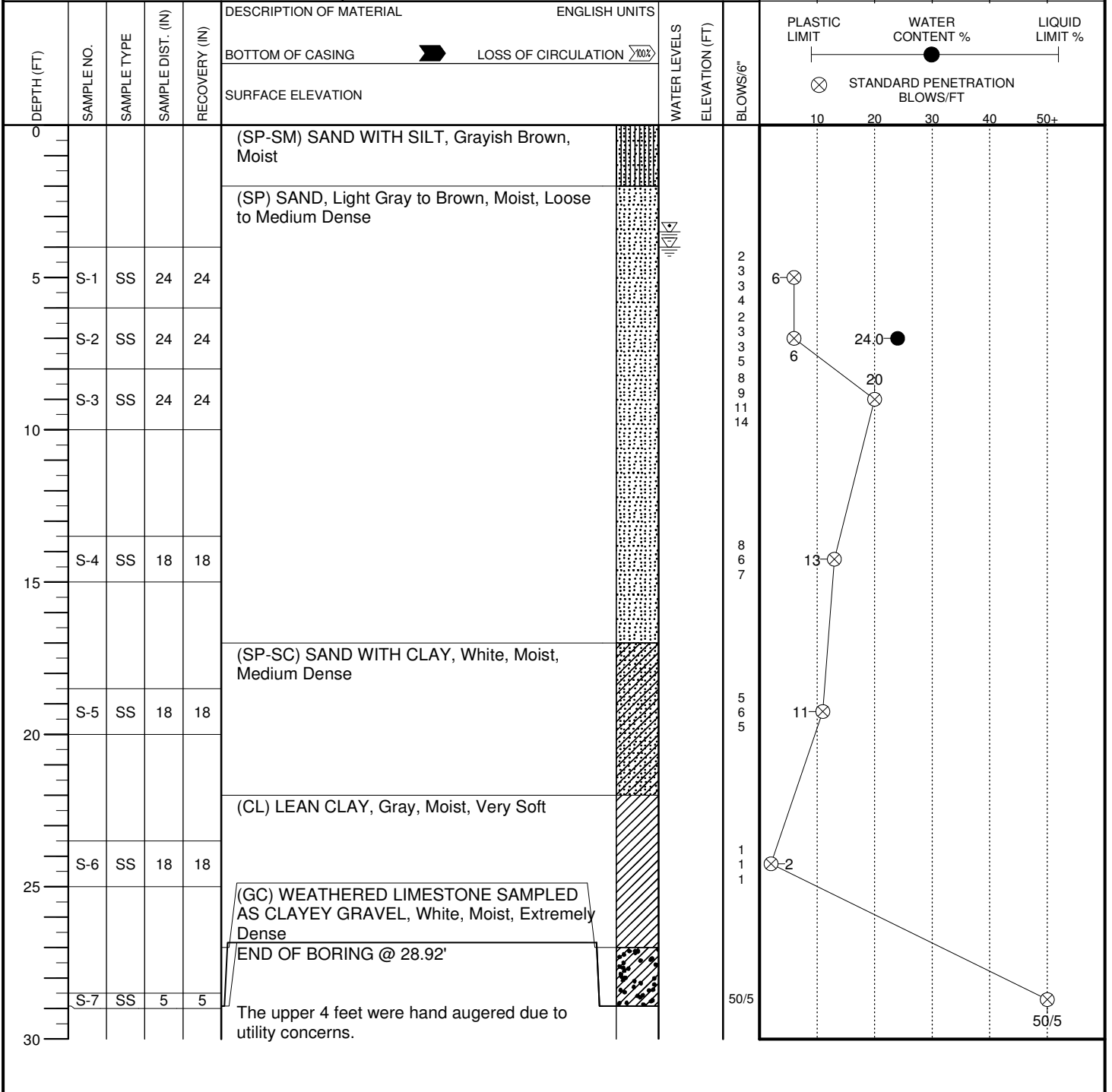
WL	Water Level	BCR	Before Casing Removal	DCI	Dry Cave-In
WS	While Sampling	ACR	After Casing Removal	WCI	Wet Cave-In
WD	While Drilling	▽	Existing Groundwater Level	▽	• Est. Seasonal High

GWT


The water levels are those water levels actually measured in the borehole at the times indicated by the symbol. The measurements are relatively reliable when augering, without adding fluids, in a granular soil. In clay and plastic silts, the accurate determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurement are generally applied.

CLIENT MRI Architectural Group, Inc.	JOB # 1329	BORING # B-1	SHEET 1 OF 1	
PROJECT NAME DMA - Tampa Red Brick Building	ARCHITECT-ENGINEER MRI Architectural Group, Inc.			

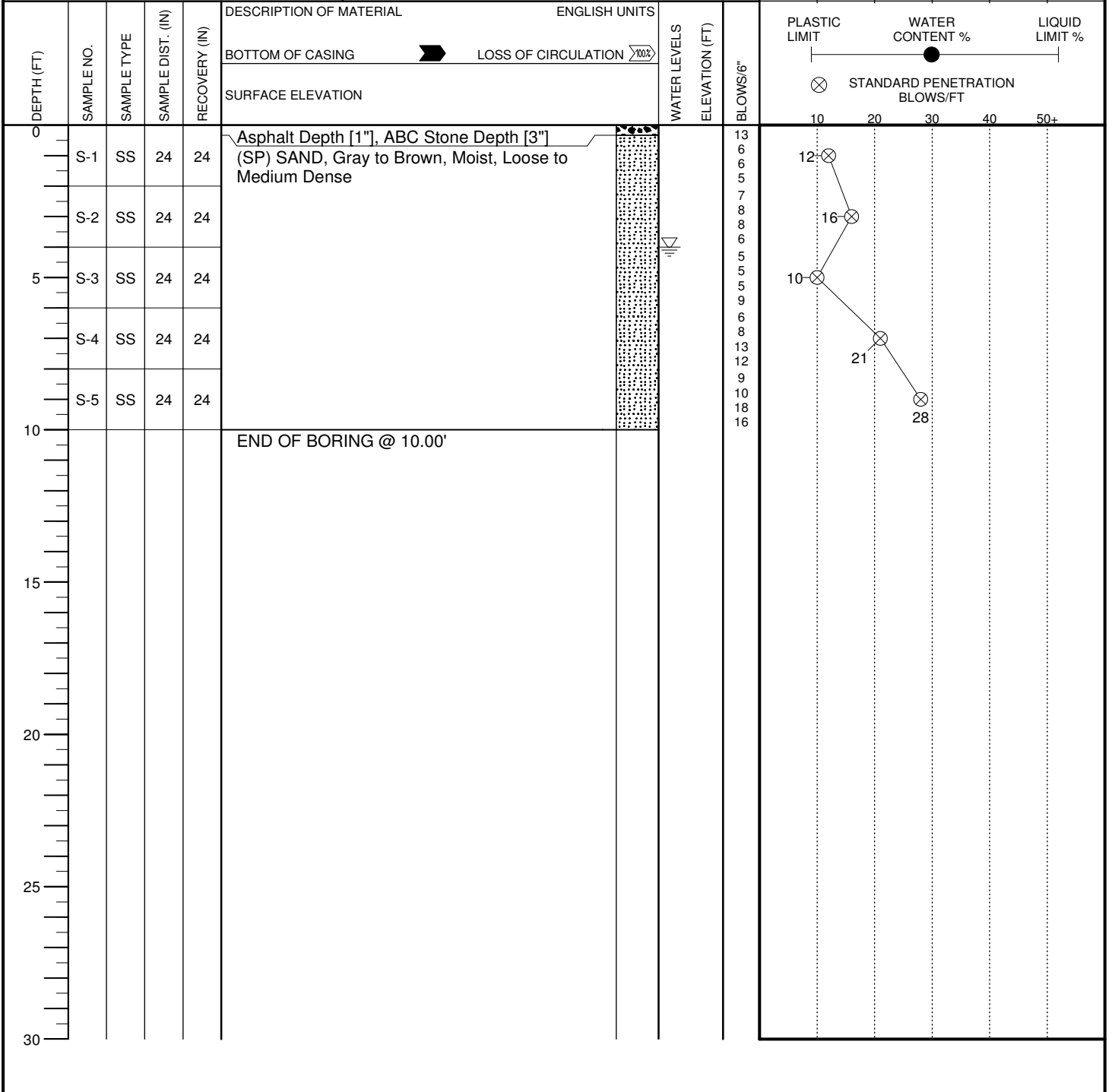
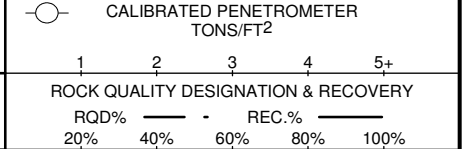
SITE LOCATION 2313 West Lemon Street, Tampa, Hillsborough County	CALIBRATED PENETROMETER TONS/FT ² 1 2 3 4 5+ ROCK QUALITY DESIGNATION & RECOVERY RQD% 20% 40% 60% 80% 100% REC.% PLASTIC LIMIT WATER CONTENT % LIQUID LIMIT % STANDARD PENETRATION BLOWS/FT 10 20 30 40 50+
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THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.					
WL 4.00	WS <input type="checkbox"/>	WD <input type="checkbox"/>	BORING STARTED	12/11/14	
WL(BCR)	WL(ACR)		BORING COMPLETED	12/11/14	CAVE IN DEPTH
WL 3.50'	Seasonal High		RIG D-25	FOREMAN Matt	DRILLING METHOD Mud Rotary

CLIENT MRI Architectural Group, Inc.	JOB # 1329	BORING # B-2	SHEET 1 OF 1	
PROJECT NAME DMA - Tampa Red Brick Building		ARCHITECT-ENGINEER MRI Architectural Group, Inc.		

SITE LOCATION
2313 West Lemon Street, Tampa, Hillsborough County



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 4.00	WS <input type="checkbox"/> WD <input type="checkbox"/>	BORING STARTED	12/11/14	
WL(BCR)	WL(ACR)	BORING COMPLETED	12/11/14	CAVE IN DEPTH
WL		RIG D-25	FOREMAN Matt	DRILLING METHOD Mud Rotary

Laboratory Testing Summary

Sample Source	Sample Number	Depth (feet)	MC ¹ (%)	Soil Type ²	Atterberg Limits ³			Percent Passing No. 200 Sieve ⁴	Moisture - Density (Corr.) ⁵		CBR Value ⁶	Other
					LL	PL	PI		Maximum Density (pcf)	Optimum Moisture (%)		
B-1	S-2	6.00 - 8.00	24.0	SP				3.6				

Notes: 1. ASTM D 2216, 2. ASTM D 2487, 3. ASTM D 4318, 4. ASTM D 1140, 5. See test reports for test method, 6. See test reports for test method
Definitions: MC: Moisture Content, Soil Type: USCS (Unified Soil Classification System), LL: Liquid Limit, PL: Plastic Limit, PI: Plasticity Index, CBR: California Bearing Ratio, OC: Organic Content (ASTM D 2974)

Project No. 1329
Project Name: DMA - Tampa Red Brick Building
PM: Chris Egan
PE: Miguel A. Santiago
Printed On: Thursday, December 18, 2014



ECS Florida, LLC

Tampa, FL



ECS No. 41-1329

NOTES:

Aerial photograph courtesy of Florida State University.

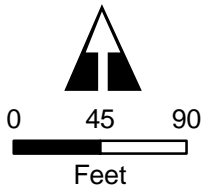


Figure 1
Boring Location Plan
DMA - Tampa Red Brick Building
2313 West Lemon Street, Tampa, Florida
Section 23, Township 29 South, Range 18 East